

23-65-33 / 100-102
Mr. A. M. Toye,
Bridge Engineer,
Bridge Division.

Attention: Mr. S. McCombie

Mr. A. G. Stermac,
Principal Foundation Engr.,
Foundation Section,
Materials & Research Division.

May 10, 1963

D.H.O. FOUNDATION INVESTIGATION REPORT --
Proposed Subway, 0.5 Miles East of Whitby,
Hwy. #2 and C.P.R., District #6, (Toronto)
W.J. 63-F-32 -- W.P. 109-63

Attached, we are forwarding to you, our detailed foundation investigation report dealing with the subsoil conditions existing at the above structure site.

We believe you will find the factual data and recommendations contained therein, adequate for your future design work. Should further information be required, please do not hesitate to contact our Office.

KYL/MdeF
Attach.

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
H. D. McMillan
G. K. Hunter (2)
C. Fraser
T. J. Kovich
A. Watt

Foundations Office
Gen. Files

KYL
K. Y. Lo,
SUPERVISING FOUNDATION ENGR.
For:
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

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FOUNDATION INVESTIGATION

For

Proposed Subway, 0.5 Miles East of Whitby,
Hwy. #2 and C.P.R., District #6, (Toronto)
W.J. 63-F-32 -- W.P. 109-63

1. INTRODUCTION:

A request dated March 12, 1963, for a foundation investigation at the site of the proposed new bridge at the C.N.R. and Hwy. #2, to replace the existing single-span bridge, was received from the Bridge Location Section.

A field investigation was carried out by this Section to determine the subsoil conditions at the site of the proposed new bridge. Presented in this report, are the results of this investigation, together with the recommendations pertaining to the design of the structure foundation and the proposed approaches.

2. DESCRIPTION OF THE SITE:

The site is about half a mile east of Whitby where Hwy. #2 underpasses the C.P.R. The existing overhead bridge is a single-span structure about 50 years old.

The topography in the area is flat, rising slightly towards the east.

The physiography of the area is referred to as the "Iroquois Plain".

3. FIELD AND LABORATORY PROCEDURE:

The field investigation was carried out by means of a diamond drill adapted for soil sampling purposes. Four boreholes

3. FIELD AND LABORATORY PROCEDURE: (cont'd.) ...

were drilled at the corners of the proposed abutment locations. No borings were carried out at the central pier location, as it is situated on the centre line of the existing Hwy. #2. Adjacent to each borehole, a dynamic cone penetration test was made. Where possible, undisturbed samples were taken by means of thin-wall samplers, while the disturbed samples were recovered by means of a 2" O.D. split-spoon sampler. Rock core was obtained with an AXT core barrel.

Tests were carried out in the laboratory to determine the Atterberg limits, moisture content, grain size distribution, and undrained shear strengths.

The results of these tests, along with the locations and elevations of the boreholes, are given in Appendix I, attached to this report.

4. SUBSOIL CONDITIONS:

4.1) General:

Subsoil conditions at the site were found to be generally uniform. From ground level downwards, the various soil types encountered, were as follows:

4.2) Clayey Silt to Silty Clay:

This deposit was found immediately below the ground surface. It was found in all boreholes, and it varied in thickness from 8.5 ft. in B.H. #1 to 14.5 ft. in B.H. #2. Generally, this deposit was found to be clayey silt, except in B.H. #2, where a

cont'd. /3 ...

4. SUBSOIL CONDITIONS: (cont'd.) ...

4.2) Clayey Silt to Silty Clay: (cont'd.) ...

distinct layer of silty clay was observed between elevations 291 and 286. The laboratory results on the clayey silt portions were as follows:

The Liquid Limit ranged from 21% to 34%, the Plastic Limit ranged from 13% to 19%, and the Moisture Content ranged from 13% to 25%. In the silty clay portion, the Atterberg limits were determined on only two samples and gave the following average results: Liquid Limit 42%, Plastic Limit 23%, Moisture Content 23%.

The 'N' values in this stratum varied between 16 and 31, placing it in the very stiff consistency range.

In B.H. #2, a thin soft layer approximately 3 ft. in thickness, was observed between elevations 287 and 284.

4.3) Glacial Till (Heterogeneous Mixture of Silt, Sand and Gravel):

Underlying the stratum of clayey silt to silty clay, is the deposit of glacial till, a heterogeneous mixture of silt, sand and gravel. The stratum was explored to the underlying bedrock in boreholes #3 and #4 (43' and 49.8', respectively), and to 26.5' and 35' in boreholes #1 and #2.

The 'N' values obtained in this stratum, ranged from 16 to over 100, indicating a relative density of compact to very dense.

4.4) Bedrock:

Shale bedrock was established in B.H. #3, while at B.H. #4, its surface was assumed to be at the refusal depth of the BX casing. It is red shale, slightly fractured in the upper portion.

cont'd. /4 ...

5. GROUND WATER CONDITIONS:

Ground water was observed during the time of investigation in all boreholes at elevations ranging between 284 and 292, some 8 ft. below the existing ground.

In addition, in B.H. #3, an artesian condition was observed in the dense till stratum, some 20 ft. below the ground. The observed head was 2 ft. above the original ground.

6. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct a new two-span subway structure at the crossing of Hwy. #2 and C.P.R., some 0.5 miles east of Whitby.

Subsoil at the site consists of 8 to 15 ft. of clayey silt, followed by dense glacial till, underlain by bedrock.

The proposed grade of Hwy. #2 is of approximate elevation 288.0. The borings revealed that the dense glacial till stratum is at approximate elevation 284.0, some 4 ft. below the proposed grade. Therefore, it is recommended that the subway be supported on strip footings founded in the very dense till stratum at elev. 283.0 or below. A safe bearing load of 3 t.s.f. may be used for design purposes. Settlement of the proposed subway, when founded as recommended, should be negligible.

No dewatering problems are anticipated because of the low permeable nature of the subsoil. Care should be taken to prevent softening of the foundation material by surface water during construction.

Stability problems are not anticipated for the proposed approach cuts with standard 2:1 side slopes.

7. SUMMARY:

It is recommended that the structure be supported on spread footings founded in the dense till stratum at elevation 283.0 or below, with a safe design load of 3 t.s.f. Settlement for the proposed subway, when founded as recommended, should be negligible. No stability problems nor dewatering problems are anticipated.

8. MISCELLANEOUS:

The field work, performed between March 29 to April 10, 1963, together with the preparation of this report, was undertaken by Mr. V. Korlu, Project Foundation Engineer. The investigation was carried out under the general supervision of Mr. M. Devata, Senior Foundation Engineer, who also reviewed this report.

Equipment was owned and operated by Dominion Soil Investigation, Ltd. of Toronto.

May 1963

APPENDIX I.

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE - - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS -

<u>CONSISTENCY</u>	<u>'N' BLOWS/FT.</u>	<u>c LB./SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

SOIL TESTS

Q _u	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Q _{cu}	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q _d	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
I_p	PLASTICITY INDEX
s	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX $= \frac{w - w_p}{I_p}$
I_C	CONSISTENCY INDEX $= \frac{w_p - w}{I_p}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX $= \frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE $= \frac{-\Delta e}{(1+e)\Delta\sigma}$
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX $= \frac{\Delta e}{\Delta \log_{10} \sigma}$
T_v	TIME FACTOR $= \frac{C_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_r	SENSITIVITY

GENERAL

π	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e \sigma$ OR $\ln \sigma$	NATURAL LOGARITHM OF σ
$\log_{10} \sigma$ OR $\log \sigma$	LOGARITHM OF σ TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL

Mr. B. Davis,
Plan and Design Branch.

Mr. C. Fraser,
District Engineer.

June 7th, 1963.

Re: B.N.O. Foundation Investigation
Report - Proposed Subway, 0.5 miles East
of Whitby, Hwy. #2, and C.P.R., District 6

We refer to the above report dated May 10th, 1963.

We note under "Ground Conditions" an artesian condition was observed at B.N.#3. The observed head was 2 feet above original ground.

Under the "Discussion and Recommendations" there is no mention of anticipated problems. We wish to point out we have had difficulty during the past few years with this artesian water condition at other locations.

Although we agree we have been able to contend with this situation with temporary outlets, etc., we are of the opinion that some emphasis should be placed on this known condition under the Special Provisions in the Contract.

This is for your information please.

HFG:ph
c.c. G. Hunter,
A. Rutka.


H. F. Gilbert,
Construction Engineer.

For: C. Fraser,
District Engineer.

Mr. A. M. Tove,
Bridge Engineer,
Bridge Division.

Mr. A. G. Sternac,
Principal Foundation Engr.,
Foundation Section,
Materials & Research Division.

Attention: Mr. B. E. Davis

June 17, 1963

D.H.C. Foundation Investigation Report - W.J. 63-F-32
Proposed Subway, 0.5 miles East of Whitby, Hwy. #2
and C.P.E., District #6 - W.P. 109-63.

We are in receipt of the copy of the memo sent to you by Mr. H. F. Gilbert, Construction Engineer, Toronto District, on June 7, 1963, concerning the artesian water conditions at the site of the proposed subway, 0.5 miles East of Whitby, Hwy. No. 2 and C.P.E., District #6.

Because the artesian condition was encountered only in one borehole, No. 3, twenty feet below existing ground level at approx. elevation 274.0, and the proposed foundation elevation is at 283.0, we felt that no problems should arise during construction. The fact that the material in which the artesian condition was encountered is a very dense till layer (Standard Penetration Test results in excess of 100), strengthened our belief that no difficulties should be encountered.

We appreciate Mr. Gilbert's concern and wholeheartedly agree with him that artesian conditions can and are causing a great deal of inconvenience. However, it should be noted that very often, difficulties are not caused by natural artesian conditions but, rather, by artificial conditions - i.e., conditions created during construction. If indiscriminate pumping is carried out from excavations in certain materials when the prevailing ground water is considerably higher than the pumping elevation, an unbalanced hydraulic head is created, resulting in instability of the bottom of the excavation. Soils appear and "quicksand" conditions develop which are then credited to natural artesian conditions rather than to improper dewatering procedure. This has been the repeated experience of the undersigned whenever he was confronted with the above-described problems at various construction sites.

AGS/MSB

A. G. Sternac
A. G. Sternac,
PRINCIPAL FOUNDATION ENGINEER

cc: Messrs. H. F. Gilbert
G. K. Hunter

Foundations Office
Gen. Files

MEMORANDUM

To: A. Stermac, P. Eng.,
Principal Foundation Engineer,
Room 107, Lab. Bldg.

From: Bridge Division,
Downsview, Ontario.

Date: February 24, 1965.

Our File Ref.

In Reply To

Subject: W.P. 109-63,
C.F.R. Subway at Whitby,
Highway No. 2 District No. 6.

I am enclosing a print of D 5303-3 which shows the sheet pile track protection for the above project. This scheme is being drastically revised because the C.P. do not like the type of bridge we proposed. Before we revise the track protection, which could be quite similar to that shown, I would like your opinion as to the feasibility of the sheet pile protection.

If you anticipate difficulty in driving sheet piling in this location, we could use H piles with timber lagging between the piles. The penetration for the H piles would have to be considerably greater than for the sheet piles.

We have to finish the new drawings by March 15th.

B. S. Richardson

BSR:go

B. S. Richardson, P. Eng.,
for B. Davis, P. Eng.,
Bridge Design Engineer.

Mr. B. P. Davis,
Bridge Design Engineer,
Bridge Division.

Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

Attention: Mr. B.S. Richardson

March 1, 1965

Your Memo -- Feb. 24/65

W.P. 109-63,
C.P.S. Subway at Whitby,
Highway No. 2 -- District No. 6.

With reference to your memo of February 24, 1965, we would like to make the following comments:

The natural soil at the site of the proposed bridge reconstruction is composed of an upper very stiff clayey silt to silty clay layer underlain by glacial till which, in turn, overlies bedrock. The upper boundary of the till layer is between approx. Elev. 283 and 287. The till is a heterogeneous mixture of silt, sand and gravel and is dense to very dense.

The proposed scheme requires the steel sheet piling to be driven 6 feet below the pier footing bottoms, or to an approximate Elevation of 277.0. The 'N' values below Elev. 280 are in excess of 100 and it is, therefore, very doubtful whether the sheet piles would penetrate to the required elevation. If such a scheme is chosen, we would certainly suggest that heavier sections be used allowing for greater driving energies to be applied.

We are also doubtful whether enough penetration could be achieved with H-piles because you indicate that the penetration of the H-piles would have to be much greater than of the steel sheet piles.

In view of the very dense character of the till layer, it is suggested that consideration be given to excavating the old fill in narrow sections rather than removing the entire half. The sheet pile wall could then be also supported somehow at the mid-height, not relying only on the upper and lower fixity.

The mid-point support could also be achieved by providing a number of horizontal borings through the fill which would accommodate the tie rods. In such a case, again the toe support would not be as essential as in the proposed arrangement. We see no difficulties in connection with the horizontal drilling.

cont'd. /2 ...

Mr. B. B. Davis
Attn: Mr. B. S. Richardson

- 2 -

March 1, 1965

The abutment footing elevations are given as 294.78 and 293.72, respectively. We would like to make sure that when these elevations were chosen, consideration was given that the footings be placed on good ground.

AGS/WdeP

cc: Foundations Office
Gen. Files

A. G. Stermas
A. G. Stermas,
PRINCIPAL FOUNDATION ENGINEER

Mr. M. Stoyanoff,
Bridge Contract Engr.,
Bridge Division.

Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

Attn: Mr. J. Banray, P.Eng.

July 15, 1965

Your Memo -- June 28/65

C.F.R. Subway at Whitby -- Piled Foundations
W.P. 109-63 -- W.J. 63-F-32A

Following your memo dated June 28, 1965, we have reviewed the Bridge Drawings for the above-mentioned structure with regard to the subsoil conditions, and submit the following comments:

(1) It is proposed to support the future abutments by means of piled foundations. In this case, we recommend that 12 BP at 74 steel H-piles be used rather than the lighter section 12 BP at 53, shown on the Drawings. It is estimated that an allowable load of 70 tons/pile will be achieved within the approximate elevation range 275.0 - 272.0, but in any event, the final safe load on the piles should be checked in the field according to D.H.C. Standards 1218 & 1219.

(2) We have no comments regarding the proposed sheet piles and tie-backs.

KGS/MgeF

cc: Mr. B. Richardson

Foundations Office
Gen. Files

K. G. Selby
K. G. Selby,
SENIOR FOUNDATION ENGR.
For:
K. Y. Lo,
SUPERVISING FOUNDATION ENGR.

MEMORANDUM

To: Mr. K. Selby, P. Eng.,
Foundation Section,
Lab. Bldg.

From: Bridge Office,
Downsview, Ontario.

DATE: June 28, 1965.

OUR FILE REF.

IN REPLY TO

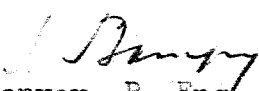
SUBJECT: W.P. 109-63,
File Foundation of C.P.R. Subway at Whitby.

It is shown on the drawings the abutments of this structure are supported by BP 12 #53 steel "H" piles, which are 25' long. The Soil Report 3A 1642 for this structure has recommended spread footings.

Since there is no confirmation in the file for this necessity, we would appreciate having your opinion on this matter.

If piles are indeed necessary, would you please advise which type and length would be most suitable.

JB/eb


J. Banyay, P. Eng.,
for M. Stoyanoff,
Bridge Contract Engineer.

*artesian water
conditions.*

Mr. A. M. Toye,
Bridge Engineer,
Bridge Division.

Mr. A. G. Stermac,
Principal Foundation Engr.,
Foundation Section,
Materials & Research Division.

Attention: Mr. B. E. Davis

June 17, 1963

D.H.O. Foundation Investigation Report - W.J. 63-F-32
Proposed Subway, 0.5 miles East of Whitby, Hwy. #2
and C.P.R., District #6 - W.P. 109-63.

We are in receipt of the copy of the memo sent to you by Mr. H. F. Gilbert, Construction Engineer, Toronto District, on June 7, 1963, concerning the artesian water conditions at the site of the proposed subway, 0.5 miles East of Whitby, Hwy. No. 2 and C.P.R., District #6.

Because the artesian condition was encountered only in one borehole, No. 3, twenty feet below existing ground level at approx. elevation 274.0, and the proposed foundation elevation is at 283.0, we felt that no problems should arise during construction. The fact that the material in which the artesian condition was encountered is a very dense till layer (Standard Penetration Test results in excess of 100), strengthened our belief that no difficulties should be encountered.

We appreciate Mr. Gilbert's concern and wholeheartedly agree with him that artesian conditions can and are causing a great deal of inconvenience. However, it should be noted that very often, difficulties are not caused by natural artesian conditions but, rather, by artificial conditions - i.e., conditions created during construction. If indiscriminate pumping is carried out from excavations in certain materials when the prevailing ground water is considerably higher than the pumping elevation, an unbalanced hydraulic head is created, resulting in instability of the bottom of the excavation. Boils appear and "quicksand" conditions develop which are then credited to natural artesian conditions rather than to improper dewatering procedure. This has been the repeated experience of the undersigned whenever he was confronted with the above-described problems at various construction sites.

AGS/mdeP

A. G. Stermac
A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

cc: Messrs. H. F. Gilbert
G. K. Hunter


Foundations Office
Gen. Files ✓

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 63-F-32 LOCATION Hwy. 2 & C.P.R. @ Whitby ORIGINATED BY V.K.
W.P. 109-63 BORING DATE March 29, 1963. COMPILED BY V.K.
DATUM Geodetic BOREHOLE TYPE Washboring CHECKED BY _____



SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	SHEAR STRENGTH P.S.F.	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT				WP	WL	WATER CONTENT % 15 30 45		
293.0	Groundlevel												
0.0	Clayey silt												
	V. stiff.		1	SS	18	290							
284.5			2	SS	18								
8.5	Glacial till (Heterogeneous mixture of silt, sand and gravel).		3	SS	17								
	Compact to v. dense.		4	SS	>100	280							
		5	SS	>100									
		6	SS	>100	270								
266.5													
26.5	End of borehole.												
											</		

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 63-F-32 LOCATION Hwy. 2 & C.P.R. @ Whitby ORIGINATED BY V.K.
W.P. 109-63 BORING DATE April 1, 1963. COMPILED BY V.K.
DATUM Geodetic BOREHOLE TYPE Washboring. CHECKED BY _____

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. + Lab. Vane ● Unconf. Comp.				
298.5	Groundlevel					300					
0.0	Clayey silt to silty clay.		1	SS	17						
	Very stiff.		2	SS	29	290					
			3	SS	17						
284.0	Soft		4	TO	P			● +			
14.5			5	SS	18						
	Glacial till (Heterogeneous mixture of silt, sand and gravel).		6	SS	42	280					
			7		>100						
			8	SS	>100						
	Dense to v. dense.	9	SS	>100	270						
263.5											
35.0	End of borehole.					260					

Gr20%Sa32%
Si32%Cl16%
Gr32%Sa41%
Si24%Cl13%

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 63-F-32 LOCATION Hwy. 2 & C.P.R. @ Whitby ORIGINATED BY V.K.
W.P. 109-63 BORING DATE April 3, 1963. COMPILED BY V.K.
DATUM Geodetic BOREHOLE TYPE Washboring CHECKED BY _____

SOIL PROFILE			SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	SHEAR STRENGTH P.S.F.	LIQUID LIMIT — % PLASTIC LIMIT — % WATER CONTENT — % *P — *L WATER CONTENT % 15 30 45	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE						
294.0	Groundlevel				300					
	Clayey silt with sand.		1	SS	18	290				
			2	SS	16					
284.5	Very stiff.		3	SS	42					
9.5	Glacial till (Heterogeneous mixture of silt, sand and gravel)		4	SS	>100	280				
			5	SS	100					
						270				
	Dense to v. dense.		6	SS	>100					
			7	SS	100					
						260				
			8	SS	100					
251.0						250				
43.0	Bedrock									
	Red shale		9	RC	-					
241.5										
52.5	End of borehole					240				

▽ 296.0

Gr 13% Sa 4.6%
Si 33% Cl 8%Gr 3% Sa 7.5%
Si 15% Cl 17%▽ 274.0
20.0Artesian
Water

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 63-F-32 LOCATION Hwy. 2 & C.P.R. @ Whitby ORIGINATED BY V.K.
W.P. 109-63 BORING DATE April 8, 1963. COMPILED BY V.K.
DATUM Geodetic BOREHOLE TYPE _____ CHECKED BY _____

SOIL PROFILE			SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE	LIQUID LIMIT — *L	PLASTIC LIMIT — *P	WATER CONTENT — *W	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	*P	*L		
301.0	Groundlevel										
0.0	Clayey silt with sand.		1	SS	17	300					
	Very stiff.		2	SS	31	290					
287.5	Glacial till (Heterogeneous mixture of silt, sand and gravel).		3	SS	46						
13.5			4	SS	100	280					
			5	SS	>100						
	Dense to v. dense.				270						
			6	SS	>100						
					260						
251.0					250						
50.0	End of borehole.										
					240						

Gr 7% Sa 44%
Si 49% Cl 10%

#63-F-32

W.P. #109-63

Hwy. #2

C.P.R.

WHITBY

